



FDS9431A_F085

P-Channel 2.5V Specified MOSFET

General Description

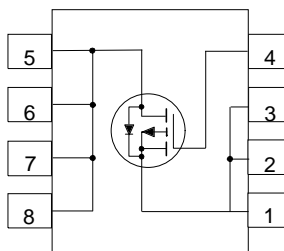
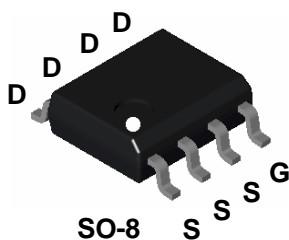
This P-Channel 2.5V specified MOSFET is produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process has been especially tailored to minimize on-state resistance and yet maintain superior switching performance.

Applications

- DC/DC converter
- Power management
- Load switch
- Battery protection

Features

- -3.5 A, -20 V. $R_{DS(ON)} = 0.130 \Omega @ V_{GS} = -4.5 V$
 $R_{DS(ON)} = 0.180 \Omega @ V_{GS} = -2.5 V$.
- Fast switching speed.
- High density cell design for extremely low $R_{DS(ON)}$.
- High power and current handling capability.
- Qualified to AEC Q101
- RoHS Compliant



Absolute Maximum Ratings T_A=25°C unless otherwise noted

| Symbol | Parameter | Rated | Units |
|-----------------------------------|--|-------------|-------|
| V _{DSS} | Drain-Source Voltage | -20 | V |
| V _{GSS} | Gate-Source Voltage | ±8 | V |
| I _D | Drain Current - Continuous (Note 1a) | -3.5 | A |
| | - Pulsed | -18 | |
| P _D | Power Dissipation for Single Operation (Note 1a) | 2.5 | W |
| | (Note 1b) | 1.2 | |
| | (Note 1c) | 1.0 | |
| T _J , T _{stg} | Operating and Storage Junction Temperature Range | -55 to +150 | °C |

Thermal Characteristics

| | | | |
|------------------|---|----|------|
| R _{θJA} | Thermal Resistance, Junction-to-Ambient (Note 1a) | 50 | °C/W |
| R _{θJC} | Thermal Resistance, Junction-to-Case (Note 1) | 25 | °C/W |

Package Marking and Ordering Information

| Device Marking | Device | Reel Size | Tape width | Quantity |
|----------------|---------------|-----------|------------|------------|
| FDS9431A | FDS9431A_F085 | 13" | 12mm | 2500 units |

FDS9431A_F085 P-Channel 2.5V Specified MOSFET

Electrical Characteristics

$T_A = 25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------------------------------------|---|--|-----|-----|------|----------------------|
| Off Characteristics | | | | | | |
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$ | -20 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = -250\ \mu\text{A}$, Referenced to 25°C | | -28 | | mV/ $^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = -16\ \text{V}, V_{GS} = 0\ \text{V}$ | | | -1 | μA |
| I_{GSSF} | Gate-Body Leakage Current, Forward | $V_{GS} = 8\ \text{V}, V_{DS} = 0\ \text{V}$ | | | 100 | nA |
| I_{GSSR} | Gate-Body Leakage Current, Reverse | $V_{GS} = -8\ \text{V}, V_{DS} = 0\ \text{V}$ | | | -100 | nA |

On Characteristics (Note 2)

| | | | | | | |
|--|--|--|------|-------------------------|-------------------------|----------------------------------|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$ | -0.4 | -0.6 | -1 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D = -250\ \mu\text{A}$, Referenced to 25°C | | 2 | | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = -4.5\ \text{V}, I_D = -3.5\ \text{A}$ $V_{GS} = -2.5\ \text{V}, I_D = -3.0\ \text{A}$ $V_{GS} = -4.5\ \text{V}, I_D = -3.5\ \text{A}$ $T_J = 125^\circ\text{C}$ | | 0.110 0.140 0.155 | 0.130 0.180 0.220 | Ω Ω Ω |
| $I_{D(on)}$ | On-State Drain Current | $V_{GS} = -4.5\ \text{V}, V_{DS} = -5\ \text{V}$ | -10 | | | A |
| g_{FS} | Forward Transconductance | $V_{DS} = -5\ \text{V}, I_D = -3.5\ \text{A}$ | | 6.5 | | S |

Dynamic Characteristics

| | | | | | | |
|-----------|------------------------------|--|--|-----|--|----|
| C_{iss} | Input Capacitance | $V_{DS} = -10\ \text{V}, V_{GS} = 0\ \text{V},$ $f = 1.0\ \text{MHz}$ | | 405 | | pF |
| C_{oss} | Output Capacitance | | | 170 | | pF |
| C_{rss} | Reverse Transfer Capacitance | | | 45 | | pF |

Switching Characteristics (Note 2)

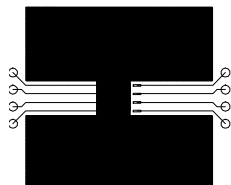
| | | | | | | |
|--------------|---------------------|--|--|-----|-----|----|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = -5\ \text{V}, I_D = -1\ \text{A},$ $V_{GS} = -4.5\ \text{V}, R_{GEN} = 6\ \Omega$ | | 6.5 | 13 | ns |
| t_r | Turn-On Rise Time | | | 20 | 35 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 31 | 50 | ns |
| t_f | Turn-Off Fall Time | | | 21 | 35 | ns |
| Q_g | Total Gate Charge | $V_{DS} = -5\ \text{V}, I_D = -3.5\ \text{A},$ $V_{GS} = -4.5\ \text{V}$ | | 6 | 8.5 | nC |
| Q_{gs} | Gate-Source Charge | | | 0.8 | | nC |
| Q_{gd} | Gate-Drain Charge | | | 1.3 | | nC |

Drain-Source Diode Characteristics and Maximum Ratings

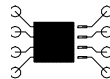
| | | | | | | |
|----------|---|---|--|------|------|---|
| I_S | Maximum Continuous Drain-Source Diode Forward Current | | | -2.1 | | A |
| V_{SD} | Drain-Source Diode Forward Voltage | $V_{GS} = 0\ \text{V}, I_S = -2.1\ \text{A}$ (Note 2) | | -0.7 | -1.2 | V |

Notes:

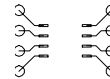
- 1: $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a) 50°C/W when mounted on a $1\ \text{in}^2$ pad of 2 oz. copper.



b) 105°C/W when mounted on a $0.04\ \text{in}^2$ pad of 2 oz. copper.



c) 125°C/W on a minimum mounting pad.

Scale 1 : 1 on letter size paper

- 2: Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2.0\%$

Typical Characteristics

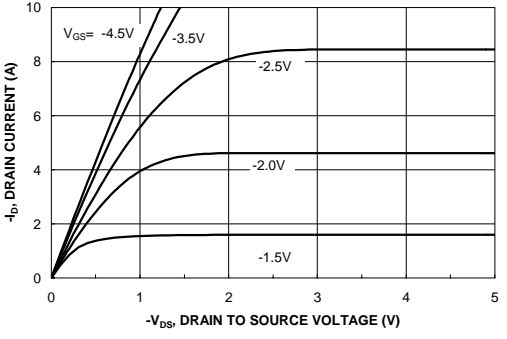


Figure 1. On-Region Characteristics.

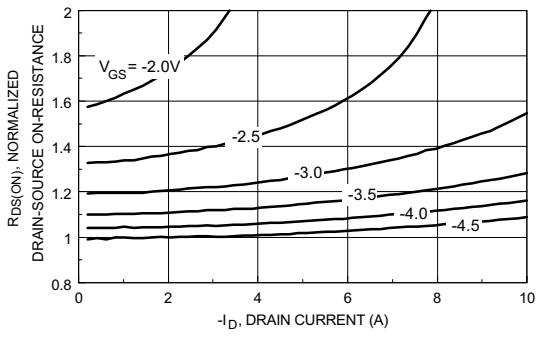


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

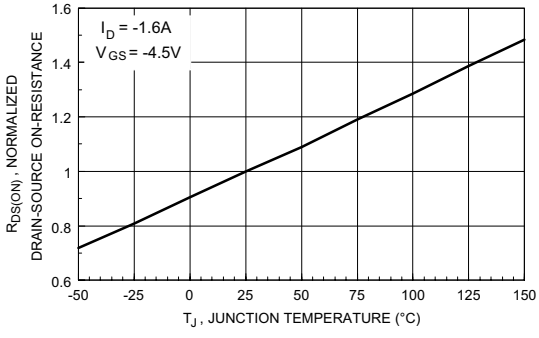


Figure 3. On-Resistance Variation with Temperature.

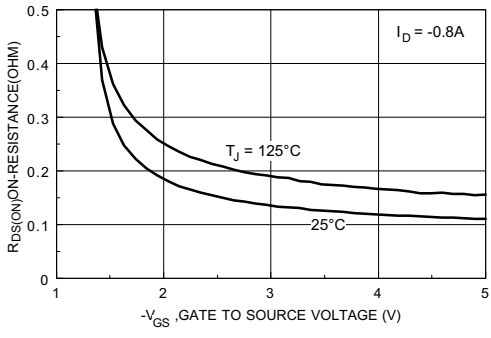


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

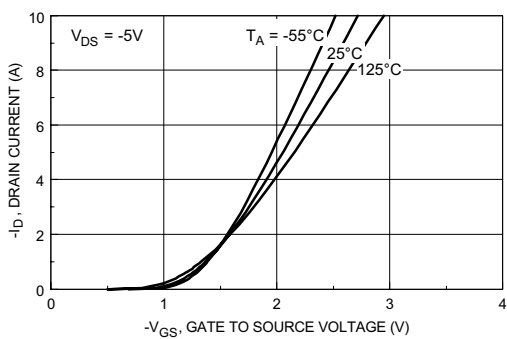


Figure 5. Transfer Characteristics.

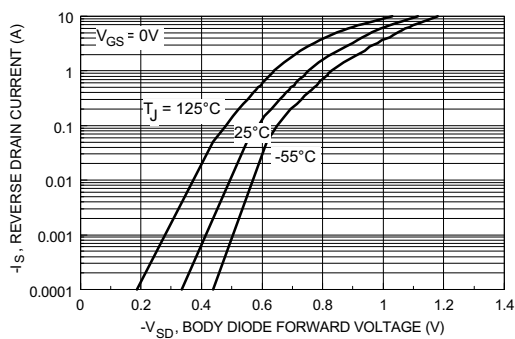


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

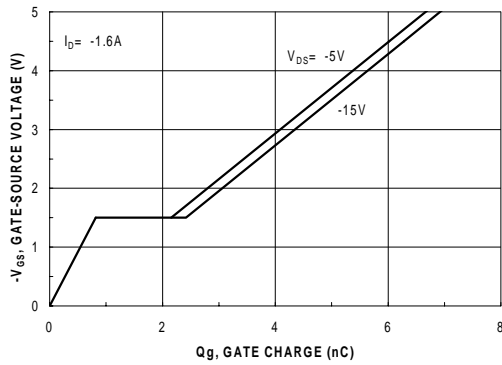


Figure 7. Gate Charge Characteristics.

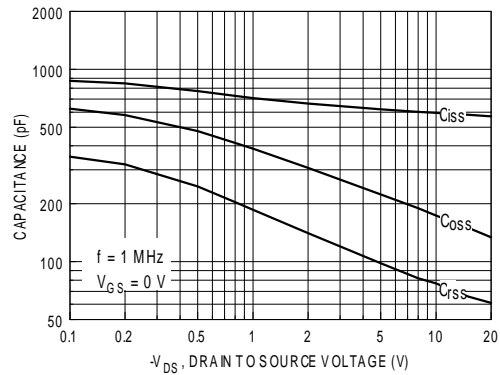


Figure 8. Capacitance Characteristics.

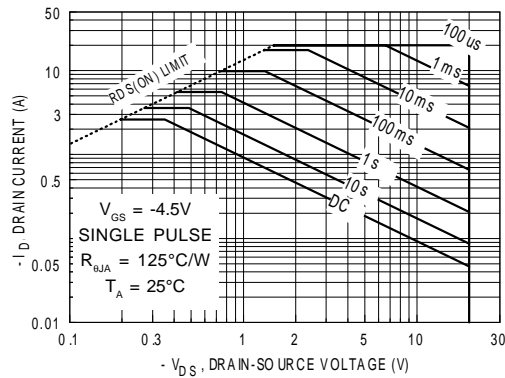


Figure 9. Maximum Safe Operating Area.

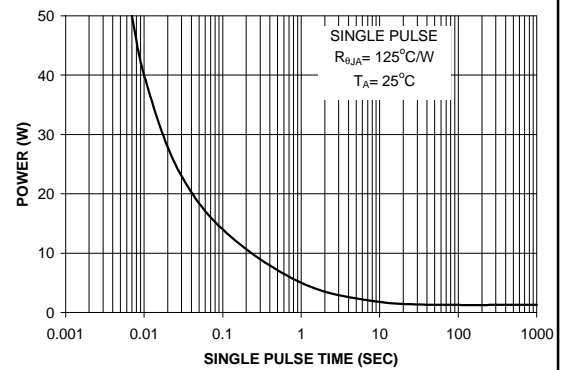


Figure 10. Single Pulse Maximum Power Dissipation.

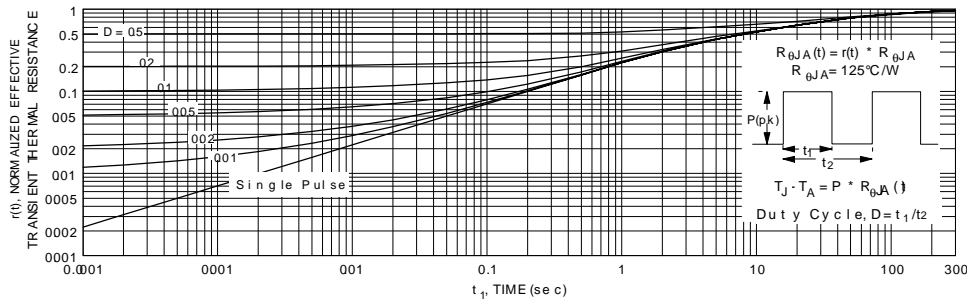







Figure 11. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1c.
Transient thermal response will change depending on the circuit board design.



TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

- | | | | |
|---|---|---|---|
| AccuPower™ | FRFET® | PowerTrench® | The Power Franchise® |
| Auto-SPM™ | Global Power Resource SM | PowerXS™ | the power® |
| Build it Now™ | Green FPS™ | Programmable Active Droop™ | franchise |
| CorePLUS™ | Green FPS™ e-Series™ | QFET® | TinyBoost™ |
| CorePOWER™ | Gmax™ | QS™ | TinyBuck™ |
| CROSSVOLT™ | GTO™ | Quiet Series™ | TinyCalc™ |
| CTL™ | IntelliMAX™ | RapidConfigure™ | TinyLogic® |
| Current Transfer Logic™ | ISOPLANAR™ |  ™ | TINYOPTO™ |
| DEUXPEED® | MegaBuck™ | Saving our world, 1mW/W/kW at a time™ | TinyPower™ |
| Dual Cool™ | MICROCOUPLER™ | SignalWise™ | TinyPWM™ |
| EcoSPARK® | MicroFET™ | SmartMax™ | TinyWire™ |
| EfficientMax™ | MicroPak™ | SMART START™ | TriFault Detect™ |
|  ® | MicroPak2™ | SPM® | TRUECURRENT™* |
| Fairchild® | MillerDrive™ | STEALTH™ | μSerDes™ |
| Fairchild Semiconductor® | MotionMax™ | SuperFET™ |  SarDes® |
| FACT Quiet Series™ | Motion-SPM™ | SuperSOT™-3 | UHC® |
| FACT® | OptiHiT™ | SuperSOT™-6 | Ultra FRFET™ |
| FAST® | OPTOLOGIC® | SuperSOT™-8 | UniFET™ |
| FastvCore™ | OPTOPLANAR® | SupreMOS™ | VCX™ |
| FETBench™ |  ® | SyncFET™ | VisualMax™ |
| FlashWriter®* | PDP SPM™ | Sync-Lock™ | XS™ |
| FPS™ | Power-SPM™ |  SYSTEM GENERAL® | |
| F-PFS™ | | | |

*Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufactures of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed application, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address and warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

| Datasheet Identification | Product Status | Definition |
|--------------------------|-----------------------|---|
| Advance Information | Formative / In Design | Datasheet contains the design specifications for product development. Specifications may change in any manner without notice. |
| Preliminary | First Production | Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
| No Identification Needed | Full Production | Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design. |
| Obsolete | Not In Production | Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only. |

Rev. I47